

## **Essential Fish Habitat Designation and Description for Coastal Pelagic Species Fishery**

(Source: Pacific Fishery Management Council. December 1998. Appendix D: Description and Identification of Essential Fish habitat for the Coastal Pelagic Species Fishery Management Plan.)

In determining EFH for the Coastal Pelagic Species (CPS), including CPS finfish (northern anchovy, Pacific sardine, Pacific (chub) mackerel, and jack mackerel) and market squid, the estuarine and marine habitat necessary to provide sufficient CPS production to support a maximum sustained yield (MSY) CPS fishery and a healthy ecosystem was considered. Using Level 1 information, (i.e., presence/absence distribution data) EFH for CPS is based upon a thermal range bordered within the geographic area where a CPS species occurs at any life stage, where the CPS species has occurred historically during periods of similar environmental conditions, or where environmental conditions do not preclude colonization by the CPS species. EFH for CPS species is derived from distributional (presence/absence) data, oceanographic data (e.g., sea surface temperatures), relationships between oceanographic variables (e.g., temperature), and other published information. Specific EFH boundaries (i.e., the habitat necessary to provide sufficient CPS production) are based on best available scientific information. Sufficient level 1 information exists to describe and identify EFH in a more precise manner for CPS finfish than for market squid.

The specific description and identification of EFH for CPS finfish accommodates the fact that the geographic range of all CPS finfish varies widely over time in response to the temperature of the upper mixed layer of the ocean, particularly in the area north of Point Arena, California (39° N latitude). This generalization is probably also true for market squid but few data are available. Adult CPS finfish are generally not found at temperatures colder than 10°C or warmer than 26°C and preferred temperatures and minimum spawning temperatures are generally above 13°C (see Figures 2-1 through 2-4). Spawning is most common at 14°C to 16°C.

The east-west geographic boundary of EFH for each individual CPS finfish and market squid is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the exclusive economic zone (EEZ) and above the thermocline where sea surface temperatures range between 10°C to 26°C. The southern boundary of the geographic range of all CPS finfish is consistently south of the US-Mexico border, indicating a consistency in sea surface temperatures at below 26°C, the upper thermal tolerance of CPS finfish. Therefore, the southern extent of EFH for CPS finfish is the United States-Mexico maritime boundary. The northern boundary of the range of CPS finfish is more dynamic and variable due to the seasonal cooling of the sea surface temperature. The northern EFH boundary is, therefore, the position of the 10°C isotherm which varies both seasonally and annually. EFH for CPS species is summarized in Table 2-1.

Sea surface temperatures and habitat boundaries for CPS finfish vary seasonally and from year to year (Figures 2-1 through 2-4). Year to year variation in temperature and habitat boundaries is most pronounced during the summer. Additionally, variation in the boundaries of preferred habitat are more pronounced than variation in the boundaries of thermal tolerance. These relationships mean that highly mobile mackerels and sardine are seasonally much more abundant in the Oregon to Alaska region during the summer and warm water years (e.g., El Nino) than during the winter and cold water years due to increased habitat availability (Pearcy et al. 1985).

In years with cold winter sea surface temperatures, the position of the 10°C isotherm (a rough estimate of the lower thermal and northern geographic bound for CPS finfish) during February is near Cape Mendocino along the coast (about 40°N latitude) and at about 43°N latitude further offshore (Figures 2-1

through 2-4). In warm years, the 10°C isotherm during February is further north along the coast but still at about 43°N latitude offshore. The 14°C isotherm (a rough measure of the location of preferred temperatures) during February is near the U.S.-Mexico border (about 31°N latitude) in cold years and near Point Arena (about 39°N latitude) in warm years.

Sea surface temperatures and habitat boundaries for CPS finfish extend farther to the north during the summer than during the winter (Figures 2-1 through 2-4). The position of the 10°C isotherm during August is off Canada and Alaska in years with both cold and warm summer sea surface temperatures. The 14°C isotherm during August is off Cape Flattery (about 43°N latitude) in cold years and off Canada above 53°N latitude in warm years. As described above, sea surface temperatures of 14°C to 16°C are generally preferred for spawning. The 16°C isotherm, and preferred spawning habitat for CPS finfish, is south of the 14°C isotherm, but shows the same patterns of variability.

Differences between spawning habitat (14°C to 16°C) and geographic range (>10°C) mean that sardine and pacific (chub) mackerel tend to move north to feed during summer and south to spawn during winter. Abundance and biomass are probably both related to the geographic extent of spawning. Pacific (chub) mackerel and sardine in particular may have increased reproductive success during warm decades (i.e., the 1930s, 1980s, and 1990s) and it is likely the carrying capacity for CPS is larger during warm water years, because the maximum preferred habitat is larger.